AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) A transcoder for converting an input Code-Excited Linear Prediction (CELP) codec stream of one format into an output CELP codec stream of another format, comprising:

a decoding unit of an input CELP codec, which converts a bitstream encoded in an input CELP codec format into a speech signal;

a transcoding filter, which performs filtering of the speech signal decoded in the decoding unit of the input CELP codec with filter characteristics calculated by adapting an optimum weight to minimize spectral distortion based on a reference filter;

a transcoding filter design unit, which extracts the optimum weight to minimize spectral distortion of the transcoding filter from a weight set, and then supplies the optimum weight to the transcoding filter, the transcoding filter design unit to:

randomly select one weight pair from a weight set;

evaluate the transcoding filter by applying the selected weight pair to the transcoding filter having a perceptual weighting filter form;

calculate a frequency response of the evaluated transcoding filter;

calculate a spectral distortion of the transcoding filter by comparing the frequency response of the reference filter with the calculated frequency response;

calculate the spectral distortion corresponding to each weight pair by evaluating the transcoding filter by applying the selected weight pair to the transcoding filter having a perceptual weighting filter form, calculating the frequency response of the evaluated transcoding filter, and calculating the spectral distortion of the transcoding filter by comparing the frequency response of the reference filter with the calculated frequency response, for every weight pair from the weight set; and

selecting a weight pair resulting in a minimum spectral distortion as the optimum

weight; and

an encoding unit of an output CELP codec, which generates a bitstream in an output CELP codec format by encoding the speech signal filtered in the transcoding filter.

2. (Previously Presented) The transcoder of claim 1, wherein the transcoding filter is a perceptual weighting filter which uses the equation

$$H_{pwf}(z) = \frac{A(z/\gamma_1)}{A(z/\gamma_2)}$$

where $A(z) = 1 - \sum_{i=1}^{p} a_i \cdot z^{-1}, p$ is a linear predictive coding (LPC) order, and γ_1 and γ_2 are weights of the perceptual weighting filter.

3. (Previously Presented) The transcoder of claim 1, wherein the transcoding filter design unit performs:

a procedure to generate the reference filter for evaluating the transcoding filter using characteristics of a perceptual weighting filter and post-filter of the input CELP codec and a perceptual weighting filter of the output CELP codec; and

based on the reference filter, a procedure to evaluate a transcoding filter weight as an optimum weight when spectral distortion is minimum.

4. (Currently Amended) A transcoding method performed in a transcoder converting an input Code-Excited Linear Prediction (CELP) codec stream of one format into an output CELP codec stream of another format, comprising:

(A) generating a transcoding filter, which has perceptual weighting filter characteristics, to which a weight minimizing a spectral distortion is applied, wherein step (A) comprises:;

(A1) generating a reference filter for evaluating the transcoding filter by using characteristics of a perceptual weighting filter and post-filter applied to the input CELP codec and of a perceptual weighting filter applied to the output CELP codec; [[and]]

(A2) randomly selecting one weight pair from a weight set;

(A3) evaluating the transcoding filter by applying the selected weight pair to the transcoding filter having a perceptual weighting filter form;

(A4) calculating a frequency response of the transcoding filter evaluated in step (B2);

(A5) calculating a spectral distortion of the transcoding filter by comparing the frequency response of the reference filter with the frequency response calculated in step (A3);

(A6) calculating the spectral distortion corresponding to each weight pair by performing steps (A3) through (A5) for every weight pair from the weight set;

(A7) selecting a weight pair resulting in a minimum spectral distortion as the weight minimizing a spectral distortion is applied; and

~~(A2)~~(A8) based on the reference filter, generating the transcoding filter, to which the weight minimizing the spectral distortion is applied, having the perceptual weighting filter characteristics[[.]];

(B) converting a bitstream encoded in an input CELP codec format into a speech signal;

(C) filtering a speech signal generated in step (B) with the transcoding filter generated in step (A); and

(D) generating a bitstream of an output CELP codec format by encoding the speech signal filtered in step (C).

5. (Canceled)

6. (Previously Presented) The method of claim 4, wherein step (A1) comprises:

(A1_1a) extracting an LPC coefficient by decoding a bitstream encoded in the input CELP codec format;

(A1_2a) evaluating the perceptual weighting filter to be used in the output CELP codec by using the LPC coefficient obtained in step (A1_1a);

(A1_3a) evaluating, as a compensation filter, a post-filter for compensating the effect of the perceptual weighting filter used for generation of the bitstream encoded in the input CELP codec format; and

(A1_4a) evaluating the reference filter by connecting the compensation filter evaluated in step (A1_3a) and the perceptual weighting filter evaluated in step (A1_2a) in series.

7. (Previously Presented) The method of claim 4, wherein step (A1) comprises:

(A1_1b) extracting the LPC coefficient by decoding the bitstream encoded in the input CELP codec format;

(A1_2b) evaluating the perceptual weighting filter to be used in the output CELP codec by using the LPC coefficient obtained in step (A1_1b);

(A1_3b) evaluating, as the compensation filter, an inverse-filter for compensating the effect of the perceptual weighting filter used for generation of the bitstream encoded in the input CELP codec format; and

(A1_4b) evaluating the reference filter by connecting the compensation filter evaluated in step (A1_3b) and the perceptual weighting filter evaluated in step (A1_2b) in series.

8. (Currently Amended) A method of designing a transcoding filter of the transcoder which includes a decoding unit of an input Code-Excited Linear Prediction (CELP) codec, which converts a bitstream encoded in an input CELP codec format into a speech signal, a transcoding filter which performs filtering of the converted speech signal with perceptual weighting filter characteristics, and an encoding unit of an output CELP codec, which generates a bitstream of an output CELP codec format by encoding the filtered speech signal, comprising:

(A) generating a reference filter by using characteristics of a perceptual weighting filter and post-filter applied to the input CELP codec and of the perceptual weighting filter applied to the output CELP codec;

(B) selecting an optimum weight which minimizes a spectral distortion of the transcoding filter from a pre-selected weight set on the basis of the reference filter, wherein step (B) comprises:

(B1) randomly selecting one weight pair from a weight set;

(B2) evaluating the transcoding filter by applying the selected weight pair to the transcoding filter having a perceptual weighting filter form;

(B3) calculating a frequency response of the transcoding filter evaluated in step (B2);

(B4) calculating a spectral distortion of the transcoding filter by comparing the frequency response of the reference filter with the frequency response calculated in step (B2);

(B5) calculating the spectral distortion corresponding to each weight pair by performing steps (B2) through (B4) for every weight pair from the weight set; and

(B6) selecting a weight pair resulting in a minimum spectral distortion as the optimum weight; and

(C) generating the transcoding filter by applying the weight selected in step (B); and

~~the generated transcoding filter operating to filter the speech signal for processing by the encoding unit~~(D) filtering the converted speech signal using the transcoding filter.

9. (Original) The method of claim 8, wherein step (A) comprises:

(A1_1a) extracting an LPC coefficient by decoding the bitstream encoded in the input CELP codec format;

(A1_2a) evaluating the perceptual weighting filter to be used in the output CELP codec by using the LPC coefficient obtained in step (A1_1a);

(A1_3a) evaluating, as a compensation filter, the post-filter for compensating the effect of the perceptual weighting filter used for generation of the bitstream encoded in the input CELP codec format; and

(A1_4a) evaluating the reference filter by connecting the compensation filter evaluated in step (A1_3a) and the perceptual weighting filter evaluated in step (A1_2a) in series.

10. (Original) The method of claim 8, wherein step (A) comprises:

(A1_1b) extracting the LPC coefficient by decoding the bitstream encoded in the input CELP codec format;

(A1_2b) evaluating the perceptual weighting filter to be used in the output CELP codec by using the LPC coefficient obtained in step (A1_1b);

(A1_3b) evaluating, as the compensation filter, an inverse-filter for compensating the effect of the perceptual weighting filter used for generation of the bitstream encoded in the input CELP codec format; and

(A1_4b) evaluating the reference filter by connecting the compensation filter evaluated in step (A1_3b) and the perceptual weighting filter evaluated in step (A1_2b) in series.

11-13. (Canceled)